

Nutrition delivery in patients admitted to critical care following major trauma, a pan-London study

Carys Davies¹, Professor Stephen Brett², Dr Lina Johansson¹, Professor Elaine Cole³

¹Nutrition and Dietetics, Imperial College Healthcare NHS Trust, ²Critical Care department, Imperial College London, ³Centre for Trauma Sciences, Queen Mary University London

Introduction

- Trauma patients often **develop malnutrition following hospital admission** (1)
- **Energy expenditure** can increase up to **200% of patients' usual values** (2)
- There are **practical challenges** to delivering nutrition in patients in the Intensive Care Unit (ICU)
- The consequence of malnutrition in trauma patients is **poorly understood**
- **Optimal nutrition** delivery **reduces** the risk of **adverse outcomes** such as **mortality, prolonged ventilation and longer hospital stays** in non-trauma populations (3,4)

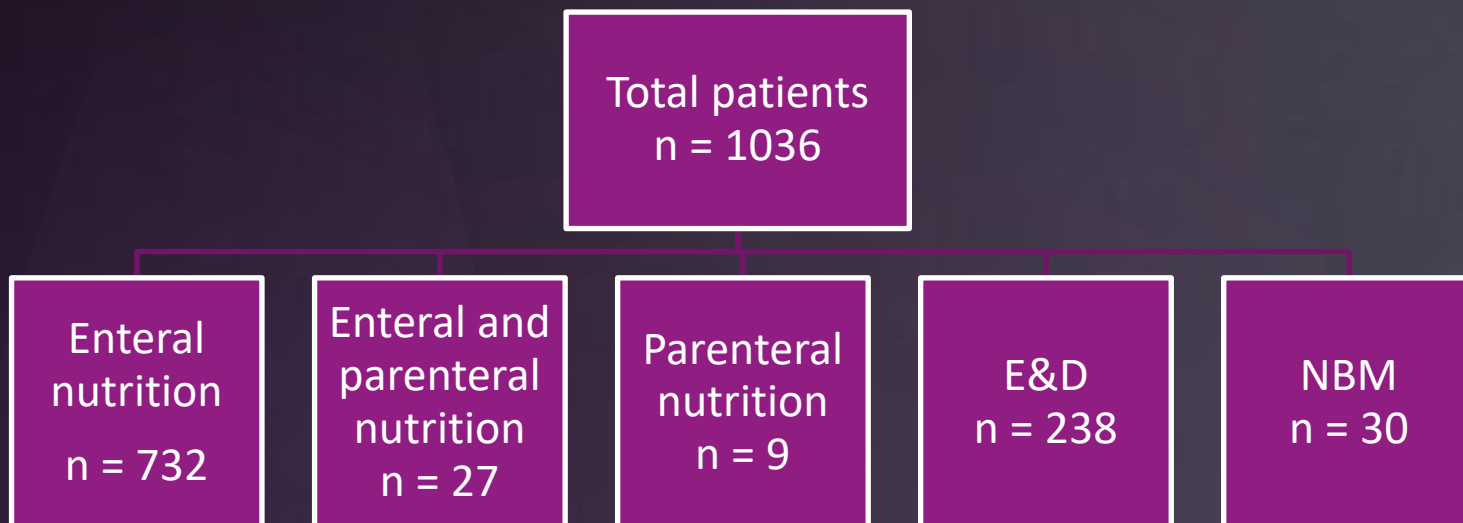
Aim

- Explore enteral **nutrition delivery and its relationship with outcomes** for major trauma patients admitted to the intensive care unit

Methodology

- A **post-hoc analysis** of the Multiple Organ Dysfunction in Elderly Trauma (**MODET**) study (5) explored nutritional parameters and delivery
- **Multicentre prospective observational study** across the London Trauma System
- Data collected daily on admission to ICU until death or discharge
- **Nutrition related data** included anthropometry, nutritional risk screening, nutritional route, products and delivery, including causes of feed interruptions
- **Descriptive statistics** used to analyse data: counts, %, mean (SD), median (IQR)
- Wilcoxon Signed-Rank test and Friedman's test were used to **assess for differences**

Figure 1: Breakdown of nutritional routes



Results

- A total number of **1036 patients** were included in the study, 266 patients who were discharged or died within 72 hours were excluded
- The median weight and BMI were 75.0kg and 24.7kg/m², **92% (n=995)** of weights were estimated
- On admission 804 (78%) of patients were considered to have a **low nutrition risk** when screened using the NUTRIC risk assessment tool

Nutrition delivery

- **Early enteral nutrition** was started in **649 (88.7%)** patients and continued for a mean of **15.7 days** (sd 7.9)
- The mean energy and protein **targets** set for patients was **23.8kcal/kg/day** (sd. 6.4) and **1.27g/kg/day** (sd. 0.34) of protein
- The mean **delivery** of energy was **17.3kcal/kg/day** (sd. 9.3) and **0.89g/kg/day** (sd. 0.48) of protein
- This mean delivery would equate **63.2% of estimated energy** and **59.3% of estimated protein requirements** (using 25kcal/kg and 1.5g/kg of protein)

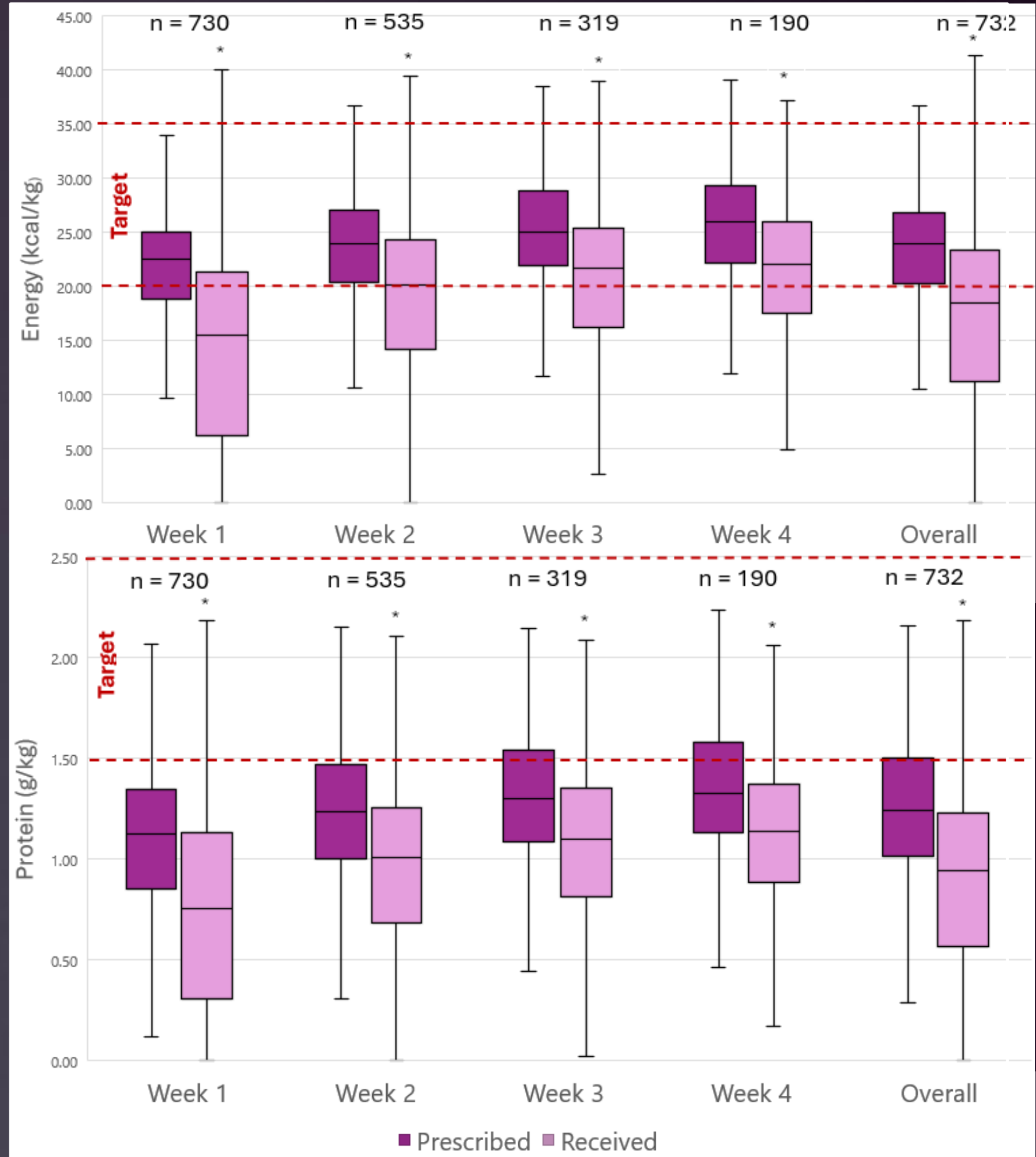
Feed interruptions

- **49%** of feed interruptions occurred during the **first week of ICU stay**
- **Fasting for procedures** was the most common cause for interruptions
- During **week 1 and 2** fasting for **extubation** and **surgical intervention** were the most common reasons for feed interruptions
- During **week 3 and 4** **displacement of feeding tubes** was the most common reason for feed interruption

Outcomes

- Patients with **lower energy and protein delivery** had a **higher APACHE II score**
- **Lower energy and protein delivery** was associated with **increased number of days on the ventilator, critical care and in hospital**

Figure 2: Energy and protein prescription and delivery in critically ill trauma patients



* $P < 0.001$ comparing prescribed and delivered (Wilcoxon Signed-Rank). Target labelled on each graph as per guidelines(6)

Table 1: Patient outcomes in energy and protein groups

	Energy				Protein			
	Group 1 0-10kcal/kg n = 38	Group 2 10-15kcal/kg n = 224	Group 3 15-20kcal/kg n = 420	Group 4 20-30kcal/kg n = 50	Group 1 0-0.5g/kg n = 45	Group 2 0.5-0.75g/kg n = 208	Group 3 0.75-1.0g/kg n = 372	Group 4 1.0-1.5g/kg n = 107
APACHE II	17.5 (12.0-22.0)	16.0 (12.0-21.0)	14.0 (10.0-19.5)	12.5 (9.0-17.0)**	18.5 (12.0-22.0)	17.0 (13.0-21.0)	14.0 (10.0-20.0)	13.0 (9.0-17.0)**
Days on MV	18.0 (13.0-24.0)	11.0 (6.0-19.0)	8.0 (5.0-15.0)	8.0 (5.0-13.0)**	17.0 (11.0-24.0)	13.0 (7.0-20.0)	8.0 (5.0-14.0)	8.0 (4.5-15.0)**
CCLOS	25.0 (19.5-30.5)	20.0 (11.0-26.0)	13.0 (8.0-19.0)	12.0 (9.0-16.0)**	25 (20.0-30.0)	21.0 (12.0-26.0)	13.0 (8.0-18.0)	12.0 (8.0-17.0)**
HLOS	48.0 (33.5-63.0)	40.0 (29.0-54.0)	33.0 (22.0-49.0)	29.0 (22.0-51.0)**	47.5 (32.5-57.5)	40.0 (29.5-58.5)	33.0 (21.0-48.5)	32.0 (23.0-57.0)**

** signifies $p < 0.01$ (Kruskal Wallis tests). MV: Mechanical ventilation; CCLOS: Critical care length of stay; HLOS: Hospital length of stay

Conclusions

- **Most patients** admitted to ICU following major trauma **require enteral nutrition**
- Patients experience **inadequate enteral nutrition delivery** throughout their ICU admission
- There is a **significant difference** between the **target and delivery** of both **energy and protein** throughout the ICU admission
- Nutrition support **guidelines are not followed** when prescribing protein
- **Deficits to nutritional targets** alongside **regular feed interruptions** result in significant **deficiencies**
- Nutritional **deficits** were associated with **higher APACHE II scores** and **worse intensive care outcomes**
- **Further investigation is required** to further explore the **causes of inadequate prescription / delivery** of nutrition and **validity of the association with outcome**

References

- (1) Dijkink S, Meier K, Krijnen P, Yeh DD, Velmahos GC, Schipper IB. Malnutrition and its effects in severely injured trauma patients. *Eur J Trauma Emerg Surg.* 2020;46(5):993-1004.
- (2) Fazzini B, Märkl T, Costas C, Blobner M, et al. The rate and assessment of muscle wasting during critical illness: a systematic review and meta-analysis. *Crit Care.* 2023 Jan 3;27(1):2.
- (3) Alberda C, Gramlich L, Jones N, Jeejeebhoy K, Day AG, Dhaliwal R, et al. The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicentre observational study. *Intensive Care Med.* 2009 Oct;35(10):1728-37.
- (4) Chapple, Lee-anne S., Marianne J. Chapman, Kylie Lange, Adam M. Deane, and Daren K. Heyland. "Nutrition support practices in critically ill head-injured patients: a global perspective." *Critical care* 20 (2015): 1-11.
- (5) Cole E, Aylwin C, Christie R, Dillane B, Farrah H, Hopkins P, et al. Multiple Organ Dysfunction in Older Major Trauma Critical Care Patients. *Ann Surg Open.* 2022 Jun 16;3(2):e174.
- (6) McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. *Journal of Parenteral and Enteral Nutrition.* 2016;40(2):159-211

No conflicts of interest. Contact details: Carys Davies | Critical Care Dietitian | carys.davies@nhs.net